



## VARIABLE-MECHANICAL-IMPEDANCE ARTIFICIAL LEGS

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This patent application claims priority of provisional patent application #60/395,938, filed July 15, 2002.

- 5           The invention relates generally to the fields of legged robotics, orthotic leg devices and prosthetic leg joints, and more specifically to artificial limbs with time-variable mechanical parameters.

### BACKGROUND

- 10           Prosthetic limbs have come a long way since the days of simple wooden "peg legs". Today, amputee men running on a prosthetic leg can beat race times of the best unimpaired women runners. It is believed that new advances in prosthetic limbs (such as those embodied in the present invention) will soon lead to amputees being able to out-perform the best unimpaired athletes of the same  
15 sex in sports such as running. It is an object of the present invention to advance the state of prosthetic limbs to a new level, providing increased athletic performance, increased control, and reduced body strain. It is a further object of the present invention to provide essential elements needed for making prosthetic limbs that more accurately mimic the mechanical behavior of healthy human  
20 limbs.

#### *Description of normal, level-ground walking:*

- In order to establish terminology used in this document, the basic walking progression from heel strike to toe off is first explained. There are three distinct phases to a walking stance-period as depicted in Figure 1 with heel-toe  
25 sequence 1 through 7.

#### *Sagittal Plane Knee Phases*

1. Beginning with heel strike, the stance knee begins to flex slightly (Sequence 1-3). This flexion allows for shock absorption upon impact as well